Amendments to the Claims

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

Claim 1 (currently amended) In a digitized tomosynthesis method for obtaining a 3D volumetric image of an object in which a ray of energy from a source travels through the object to impinge on an energy sensor defining an image plane and in which the object is rotated about an axis whereby an image is acquired by the energy sensor at successive rotational positions of the object, the improvement according to which the object, but not the energy source, is rotated about an axis of rotation, the axis of rotation of the object being at a canted angle with respect to the image plane.

Claim 2 (original) The method of claim 1 in which the energy is in the form of electromagnetic radiation.

Claim 3 (original) The method of claim 2 in which the electromagnetic radiation is x-ray radiation.

Claim 4 (original) The method of claim 1 in which the energy sensor is a flat panel digital detector.

Claim 5 (original) The method of claim 1 in which the optical axis of the source is perpendicular to the image plane.

Claim 6 (previously amended) The method of claim 1 in which a ray of energy from the source is mathematically traced through a voxel of the object space to the image plane, a coordinate of a shadow of the voxel on the image plane is computed for each object rotation, and image data is extracted and combined to form the object space voxel.

Claim 7 (previously amended) In a digitized tomosynthesis method for obtaining a 3D volumetric image of an object in which a ray of energy from a source

travels through the object to impinge on an energy sensor defining an image plane and in which the object is rotated about an axis whereby an image is acquired by the energy sensor at successive rotational positions of the object, the improvement according to which the object is rotated about an axis of rotation at a canted angle with respect to the image plane, and the source and object angles relative to the energy sensor are determined, comprising:

determining the axis of rotation of the object;

placing a first registration marker that is substantially opaque to the energy on a first location proximate the sensor and along the object's axis of rotation;

obtaining a first shadow image corresponding to the first registration marker by exposing the first registration marker to energy from the energy source;

placing a second registration marker that is substantially opaque to energy levels at a location distal from the sensor, spaced a predetermined distance from said first location along the object's axis of rotation;

obtaining a second shadow image corresponding to the second registration marker by exposing the second registration marker to energy from the energy source; and

comparing a location of the first shadow image and a location of the second shadow image to determine the source and object angles relative to the energy sensor.

Claim 8 (original) The method of claim 7 wherein the first registration marker and the second registration marker are the same marker.

Claim 9 (original) The method of claim 8 wherein the second registration marker is supported at the predetermined distance by a pedestal.

Claim 10 (original) The method of claim 9 wherein the pedestal is substantially transparent to said ray of energy.

Claim 11 (original) The method of claim 7 wherein the orientation between the energy source and the sensor surface comprises information including at least one of an angle of misalignment and an angle of inclination of the rotational axis of the object.

Claim 12 (original) The method of claim 11 wherein the orientation between the energy source and the sensor surface comprises both the angle of misalignment and the angle of inclination of the rotational axis of the object

Claim 13 (original) The method of claim 7 further comprising the steps of:

positioning an object proximate the surface of the energy sensor;

obtaining one or more object shadow images with the energy sensor by exposing the object to energy from the energy source; and

manipulating the one or more object shadow images as a function of the orientation between the energy source and the sensor surface.

Claim 14 (original) The method of claim 13 further comprising the steps of: rotating at least one of the energy source and the object about a center of rotation to a plurality of rotational positions; obtaining an object shadow image at each of the plurality of rotational positions by exposing the object to energy from the energy source at each of the plurality of rotational positions; combining object shadow images obtained at the plurality of rotational positions to obtain a three-dimensional image of the object; and manipulating the three-dimensional image of the object as a function of the orientation between the energy source, the rotational axis of the object, and the sensor surface.

Claim 15 (currently amended) In a digitized tomosynthesis system for obtaining a 3D volumetric image of an object in which a ray of energy from a source travels through the object to impinge on an energy sensor defining an image plane and in which the object , but not the energy source, is rotated about an axis whereby an image is acquired by the energy sensor at successive rotational positions of the object, the improvement according to which the system includes a support for the object enabling the object to be rotated about an axis of rotation, the axis of rotation of the object being at a canted angle with respect to the image plane.

Claim 16 (original) The system of claim 15 in which the energy is in the form of electromagnetic radiation.

Claim 17 (original) The system of claim 16 in which the electromagnetic radiation is x-ray radiation.

Claim 18 (original) The system of claim 15 in which the energy sensor is a flat panel digital detector.

Claim 19 (original) The system of claim 15 in which the optical axis of the source is perpendicular to the image plane.

Claim 20 (previously amended) The system of claim 15 including a computer chip containing one or more computer programs for enabling a ray of energy from the source to be mathematically traced through a voxel of the object space to the image plane, for computing a coordinate of a shadow of the voxel on the image plane for each object rotation, and for extracting image data, and for combining the extracted image data to form the object space voxel.

Claim 21 (previously amended) In a digitized tomosynthesis system for obtaining a 3D volumetric image of an object in which a ray of energy from a source travels through the object to impinge on an energy sensor defining an image plane and in which the object is rotated about an axis whereby an image is acquired by the energy sensor at successive rotational positions of the object, the improvement according to which the system includes a support for the object enabling the object to be rotated about an axis of rotation at a canted angle with respect to the image plane, the system including a computer chip containing one or more computer programs for enabling a ray of energy from the source to be mathematically traced through a voxel of the object space to the image plane, for computing a coordinate of ~~the~~ a shadow of the voxel on the image plane for each object rotation, and for extracting image data, and for combining the extracted image data to form the object space voxel, and enabling the source and object angles to be determined relative to the energy sensor by further comprising:

at least one mechanism for determining the axis of rotation of the object;

a first registration marker that is substantially opaque to the energy disposed on a first location proximate the sensor and along the object's axis of rotation whereby to enable a first shadow image corresponding to the first registration marker to

be obtained when the first registration marker is exposed to energy from the energy source; and

a second registration marker that is substantially opaque to energy levels disposed at a location distal from the sensor, spaced a predetermined distance from said first location along the object's axis of rotation whereby to enable a second shadow image corresponding to the second registration marker to be obtained by exposing the second registration marker to energy from the energy source;

said one or more computer programs being capable of comparing a location of the first shadow image and a location of the second shadow image to determine the source and object angles relative to the energy sensor.

Claim 22 (original) The system of claim 21 wherein the first registration marker and the second registration marker are the same marker.

Claim 23 (original) The system of claim 22 wherein the second registration marker is supported at the predetermined distance by a pedestal.

Claim 24 (original) The system of claim 23 wherein the pedestal is substantially transparent to said ray of energy.

Claim 25 (original) The system of claim 21 wherein the orientation between the energy source and the sensor surface comprises information including at least one of an angle of misalignment and an angle of inclination of the rotational axis of the object.

Claim 26 (original) The system of claim 25 wherein the orientation between the energy source and the sensor surface comprises both the angle of misalignment and the angle of inclination of the rotational axis of the object

Claim 27 (original) The system of claim 21 further comprising:

an object positioned proximate the surface of the energy sensor; and

a mechanism for obtaining one or more object shadow images with the energy sensor by exposing the object to energy from the energy source;

said one or more computer programs being capable of manipulating the

one or more object shadow images as a function of the orientation between the energy source and the sensor surface.

Claim 28 (original) The system of claim 27 further comprising a mechanism for rotating at least one of the energy source and the object about a center of rotation to a plurality of rotational positions, and obtaining an object shadow image at each of the plurality of rotational positions by exposing the object to energy from the energy source at each of the plurality of rotational positions; and said one or more computer programs being capable of combining object shadow images obtained at the plurality of rotational positions to obtain a three-dimensional image of the object, and manipulating the three-dimensional image of the object as a function of the orientation between the energy source, the rotational axis of the object, and the sensor surface.

Claim 29 (currently amended) An apparatus for representing an internal structure of an object by digitized tomosynthesis in which a ray of energy from a source travels through an object to impinge on an energy sensor defining an image plane and in which the object is rotated about an axis , but not the energy source, whereby a 3D volumetric image of an object is acquired by the energy sensor at successive rotational positions of the object, the improvement according to which the apparatus includes a support for the object enabling the object to be rotated about an axis of rotation, the axis of rotation of the object being at a canted angle with respect to the image plane.

Claim 30 (previously amended) The apparatus of claim 29 in which the energy is in the form of electromagnetic radiation.

Claim 31 (previously amended) The apparatus of claim 30 in which the electromagnetic radiation is x-ray radiation.

Claim 32 (previously amended) The apparatus of claim 29 in which the energy sensor is a flat panel digital detector.

Claim 33 (previously amended) The apparatus of claim 29 in which the optical axis of the source is perpendicular to the image plane.

Claim 34 (previously amended) The apparatus of claim 29 including a computer chip containing one or more computer programs for enabling a ray of energy from the source to be mathematically traced through a voxel of the object space to the image plane, for computing a coordinate of a shadow of the voxel on the image plane for each object rotation, and for extracting image data, and for combining the extracted image data to form the object space voxel.

Claim 35 (previously amended) An apparatus for representing an internal structure of an object by digitized tomosynthesis in which a ray of energy from a source travels through an object to impinge on an energy sensor defining an image plane and in which the object is rotated about an axis whereby a 3D volumetric image of an object is acquired by the energy sensor at successive rotational positions of the object, the improvement according to which the apparatus includes a support for the object enabling the object to be rotated about an axis of rotation at a canted angle with respect to the image plane, the apparatus including a computer chip containing one or more computer programs for enabling a ray of energy from the source to be mathematically traced through a voxel of the object space to the image plane, for computing a coordinate of a shadow of the voxel on the image plane for each object rotation, and for extracting image data, and for combining the extracted image data to form the object space voxel and enabling the source and object angles to be determined relative to the energy sensor, the apparatus further comprising:

at least one mechanism for determining the axis of rotation of the object;

a first registration marker that is substantially opaque to the energy disposed on a first location proximate the sensor and along the object's axis of rotation whereby to enable a first shadow image corresponding to the first registration marker to be obtained when the first registration marker is exposed to energy from the energy source; and

a second registration marker that is substantially opaque to energy levels disposed at a location distal from the sensor, spaced a predetermined distance from said first location along the object's axis of rotation whereby to enable a second shadow image corresponding to the second registration marker to be obtained by exposing the second registration marker to energy from the energy source;

said one or more computer programs being capable of comparing a location of the first shadow image and a location of the second shadow image to determine the source and object angles relative to the energy sensor.

Claim 36 (previously amended) The apparatus of claim 35 wherein the first registration marker and the second registration marker are the same marker.

Claim 37 (previously amended) The apparatus of claim 36 wherein the second registration marker is supported at the predetermined distance by a pedestal.

Claim 38 (previously amended) The apparatus of claim 37 wherein the pedestal is substantially transparent to said ray of energy.

Claim 39 (previously amended) The apparatus of claim 35 wherein the orientation between the energy source and the sensor surface comprises information including at least one of an angle of misalignment and an angle of inclination of the rotational axis of the object.

Claim 40 (previously amended) The apparatus of claim 39 wherein the orientation between the energy source and the sensor surface comprises both the angle of misalignment and the angle of inclination of the rotational axis of the object

Claim 41 (previously amended) The apparatus of claim 35 further comprising:

an object positioned proximate the surface of the energy sensor; and

a mechanism for obtaining one or more object shadow images with the energy sensor by exposing the object to energy from the energy source;

said one or more computer programs being capable of manipulating the one or more object shadow images as a function of the orientation between the energy source and the sensor surface.

Claim 42 (previously amended) The apparatus of claim 41 further comprising a mechanism for rotating at least one of the energy source and the object about a center of rotation to a plurality of rotational positions, and obtaining an object shadow image at each of the plurality of rotational positions by exposing the object to

energy from the energy source at each of the plurality of rotational positions; and said one or more computer programs being capable of combining object shadow images obtained at the plurality of rotational positions to obtain a three-dimensional image of the object, and manipulating the three-dimensional image of the object as a function of the orientation between the energy source, the rotational axis of the object, and the sensor surface.